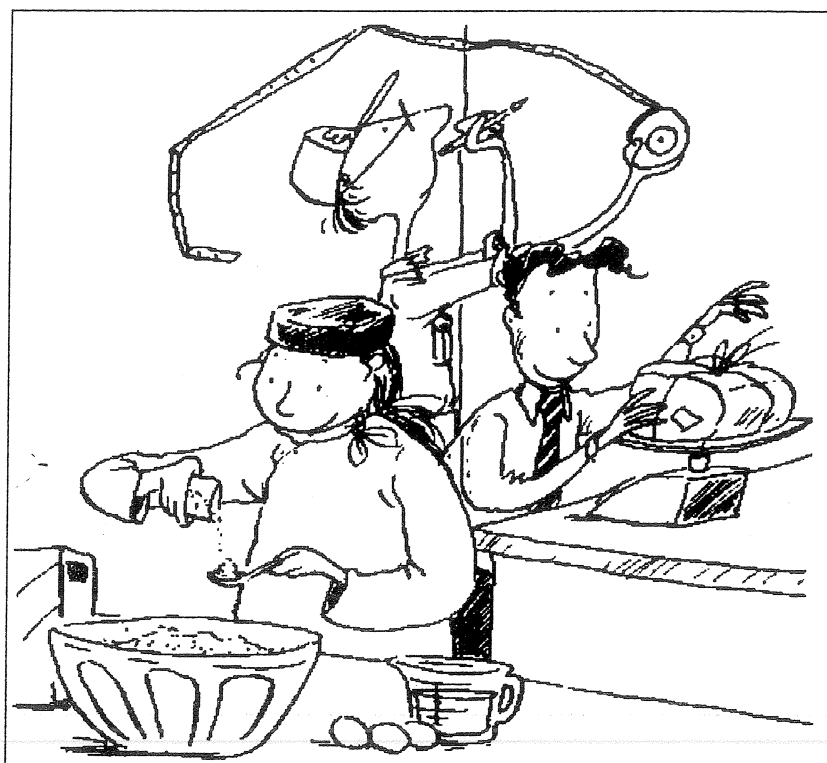


# Module 9

## Workplace Numeracy



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# Board of Studies Syllabus Links

## Links to Work Education, Work Studies CEC and Work and the Community Life Skills course

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**WORK EDUCATION**  
Stage 5

**WORK STUDIES CEC**  
Stage 6

**WORK AND  
THE COMMUNITY  
LIFE SKILLS  
COURSE**  
Stage 6

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Elective 10 Workplace Literacy  
and Numeracy

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## Links to Industry Curriculum Framework Courses

This module may be used to support the delivery of Stage 6 Industry Curriculum Framework courses. Teachers should use their professional judgement to determine the relevance of the materials to the units of competency being delivered. The materials should be placed in an industry-specific context.

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# Introduction

Numeracy is a word used to describe basic skills in mathematics that are used every day. It may be as simple as getting to a job interview on time (knowing how to read a train timetable) or as complicated as building a bridge (using complex mathematical formulas to calculate stress and load-bearing capacity).

It is easy to forget how often numeracy skills are used in the workplace. For example:

- Filling a large hot-water urn with a smaller container may require an estimation of volume.
- Working out whether the amount of goods packed into a box is going to be too heavy to lift involves estimating weight.
- Deciding whether a new storage cupboard is going fit in a particular space involves working with length, height and width.
- Budgeting with wages requires the operational skills.
- Using a train timetable means reading the table format and calculating travel times.
- Cooking processes combine temperature and time values.
- Understanding a pay slip involves reading column entries.
- Getting out of the lift at the right floor requires number recognition skills.



Numeracy is around us all the time in the workplace!

## 9.1 Measurement in the Workplace

One of the most common mathematical activities in the workplace is measurement. Different types of measuring skills are needed in different industries.

For example, the metal industry measures to hundredths of a millimetre. Think of the length of just one millimetre and imagine trying to cut it into 100 equal pieces. Some industries, like the mining industry, work in hundreds of tonnes at a time. This is like digging up a whole football field.

Some of the most common measuring activities involve:

length      weight      volume.

### Length

#### What Is Length?

Length is the measure of an object from one end to the other; for example, how far a boat covers from stern to bow, or the space between two poles.

Some of the tools used for measuring length are 30-centimetre rulers, metre rulers, metre tapes, retractable tapes, trundle wheels, vehicle odometers. Sometimes, for really fine measurements, callipers and feeler gauges are used.

#### Standard Metric Units of Length

The base SI (standard international) unit of length is the metre. The other standard units are based on it. The most common of these other standard metric units are:

- millimetres
- centimetres
- kilometres.

1 centimetre (cm) = 10 millimetres (mm)

1 metre (m)            = 1000 millimetres (mm)  
                               = 100 centimetres (cm)

1 kilometre (km) = 1000 metres (m)

The correct unit of length and measuring tool to use will depend on the size of an object or the distance to be measured. For example, the length of a sheet of notepaper would be measured in millimetres or centimetres rather than in metres. Some jobs may need measurements in units smaller than millimetres.

## Measuring in Millimetres (mm)

Millimetres are usually the smallest standard unit of length required for measurement. Measuring in millimetres takes a lot of concentration to do accurately. Sometimes the measurement may be in the thousands. For example, the length of a desk may be 1200 mm.



### ACTIVITY

### Measurement in the Workplace

#### A. Estimating in Millimetres

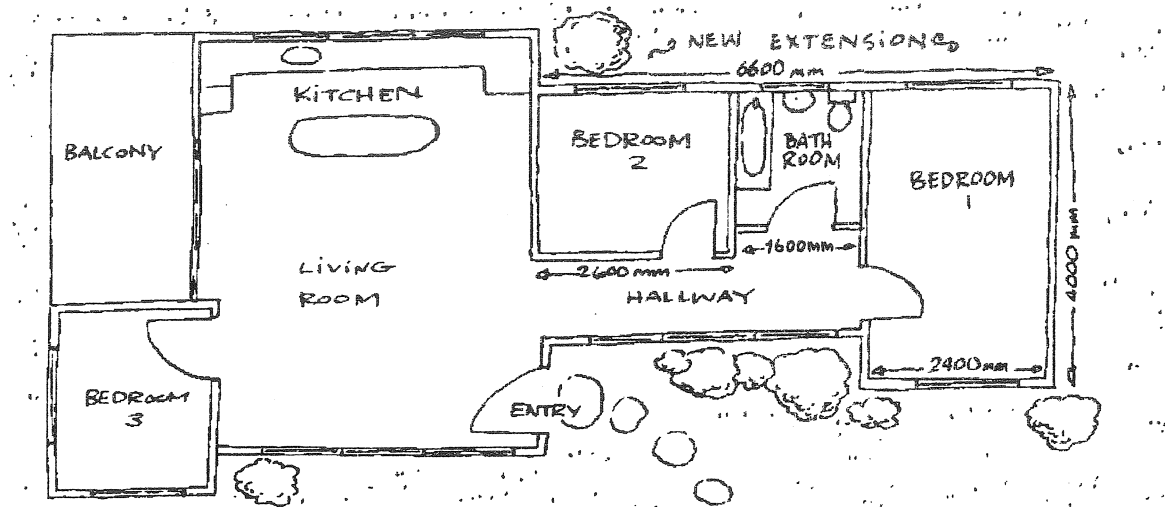
Find five items that measure between 20 and 200 mm. List them in the box below. Estimate their length. Check your estimate by measuring. Record your estimates and measurements in the table below.

Item	Estimate (mm)	Actual Length (mm)

## B. Using Scale

In many trade industries, measuring items in millimetres is the standard practice. On building plans, for example, all measurements are recorded in millimetres.

The builder you work for has just signed a contract to build the following extension to a customer's house.



Use the information on the house plan to answer the following questions.

- 1) What is the overall length of the extension? \_\_\_\_\_
- 2) What is the overall width of the extension? \_\_\_\_\_
- 3) How wide is the bathroom? \_\_\_\_\_
- 4) How wide is the largest bedroom? \_\_\_\_\_
- 5) How long is the hallway? \_\_\_\_\_

## Measuring in Centimetres (cm)

If there is no standard industry unit, it may be easier to use centimetres to measure everyday items. Most tape measures and rulers have centimetres recorded on them. Measuring in centimetres also involves knowing how to read and record *parts* of a centimetre. Parts of a centimetre can be written as a decimal.

For example, this line is 2.4 centimetres long. \_\_\_\_\_

This means that it is 2 centimetres plus 0.4 of a centimetre long. 0.4 centimetres is the same as  $\frac{4}{10}$  of a centimetre, or 4 millimetres.

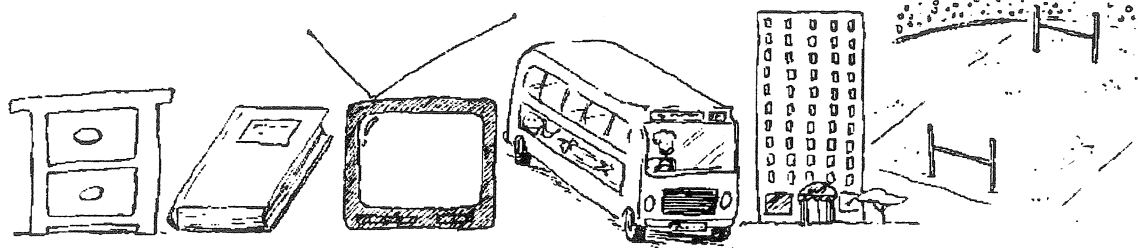


### ACTIVITY

### Measurement in the Workplace

### Measuring in Centimetres

- 1) Tick the items you would usually measure in centimetres.



- 2) Find the five items listed below. Estimate their length. Check your estimate by measuring. Record your estimates and measurements in the spaces provided.

Item	Estimate (cm)	Measurement (cm)
Pen		
Pencil sharpener		
Writing book		
Folder		
Pencil case		

## Measuring in Metres (m)

Large objects or distances are usually measured in metres.

Two people may be needed to measure larger distances — one to hold the measuring tape at one end, and the other to read the total length at the other end. Some tape measures are designed to overcome this problem. They have a special fitting at the end to hold it in place while the length is measured.

There are also other types of measuring tools for long distances, for example trundle wheels.

It is important to know how to read and record *parts* of a metre. Parts of a metre are measured in tenths of a metre and are written as a decimal. Each tenth ( $1/10$ ) of a metre is written as 0.1 of a metre.

Think about this:      1.5 m means one metre plus  $5/10$  of a metre

1.2 m means one metre plus  $2/10$  of a metre.

We also know that:      10 cm = 0.1 m =  $1/10$  m

and that:                100 cm = 1 m.

For example:            150 cm = 1.5 m

120 cm = 1.2 m.



### ACTIVITY

#### Measurement in the Workplace

### A. Converting to Metres

Write these measurements in decimal parts of a metre.

180 cm \_\_\_\_\_ 160 cm \_\_\_\_\_ 210 cm \_\_\_\_\_ 340 cm \_\_\_\_\_

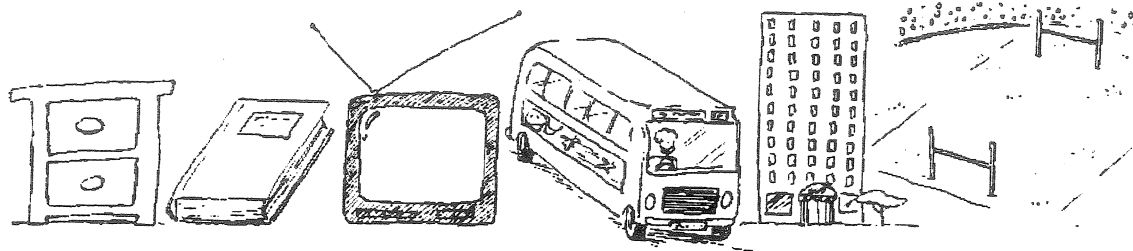
70 cm \_\_\_\_\_ 90 cm \_\_\_\_\_ 185 cm \_\_\_\_\_ 155 cm \_\_\_\_\_

215 cm \_\_\_\_\_ 485 cm \_\_\_\_\_ 55 cm \_\_\_\_\_ 85 cm \_\_\_\_\_



## B. When to Use Metres

Tick the items you would usually measure in metres.



## C. Indoor Estimates

Estimate the length and height of each item listed below. Check your estimate by measuring each item with a metre ruler or tape, as well as a retractable tape. Record your estimates and measurements in the spaces provided. Discuss which tool was the most accurate and easiest to use for each item.

Item	Estimate (m)	Metre ruler/tape	Retractable tape
Your height			
Height of a friend			
Length of classroom			
Length of desk			
Height of classroom door			

## D. Outdoor Estimates

Now try some outside measurements. Estimate each measurement first, then check it. This time use a metre ruler, a retractable tape and a trundle wheel. Again, discuss the ease and accuracy of each tool.

Item	Estimate (m)	Metre ruler	Retractable tape	Trundle wheel
Length of assembly hall				
Width of quadrangle				
Length of classroom block				
Width of playground				

## Measuring in Kilometres (km)

In most jobs, measuring in kilometres is not needed except where travelling is involved.

Some workers are required to use a car to complete parts of their job. The car they use may be a company car or it might be their own. Many businesses pay a travel allowance when employees use their own car, or the travel can be claimed as a tax deduction.

In order to claim for travel, you must keep a record of the kilometres travelled. This information is usually written in a book called a travel log.



Most cars have a tripmeter, which can be set to start at 0 and will then record the number of kilometres travelled. It usually records whole kilometres and tenths of a kilometre.

For example, the total distance of a work trip may be 58.3 km. This information should be recorded in the log. In this case, a calculation to the nearest whole unit is needed. This is called *rounding*. When rounded, 58.3 km is entered in the log as 58 km, because 58 is the nearest whole number.



### ACTIVITY

#### Measurement in the Workplace

#### A. Rounding

- 1) Numbers like 58.1, 58.2, 58.3 and 58.4 would probably be rounded down to \_\_\_\_\_.
- 2) Numbers like 58.5, 58.6, 58.7, 58.8 and 58.9 would be rounded up to \_\_\_\_\_.
- 3) Round these numbers to the nearest whole number.

16.3 \_\_\_\_\_ 28.6 \_\_\_\_\_ 32.1 \_\_\_\_\_

17.8 \_\_\_\_\_ 72.2 \_\_\_\_\_ 36.7 \_\_\_\_\_

#### B. Travel

- 1) Julia is paid a travel allowance of 50c per kilometre for driving her car for work.

If she drove 65 km on a work trip, the allowance is calculated by multiplying 50c by 65. Remember that 50c is half, or 0.5, of a dollar. The travel allowance could be calculated this way:

$$65 \text{ km} \times \$0.5 = \$32.50.$$

Think of some other ways to calculate this travel allowance. Write them here.

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2) Dimitri has a small car and can claim a travel allowance of 25c per kilometre. What fraction of a dollar is 25c? \_\_\_\_\_ Write it as a decimal. \_\_\_\_\_

3) How much would he receive for driving these distances?

30 km  $30 \times 0.25 = \$$  \_\_\_\_\_ 48 km = \_\_\_\_\_  $\times 0.25 = \$$  \_\_\_\_\_

64 km \_\_\_\_\_ 120 km \_\_\_\_\_

### C. Motor Vehicle Running Sheet

Date	From	To	Purpose of trip	Km
6/5/00	Penrith	City	Delivery of goods	72
	City	P'matta	Pick up goods	32
	P'matta	Penrith	Back to depot	45
7/5/00	Penrith	Mt Druitt	Maintenance call	17
	Mt Druitt	St Marys	Pick up parts	8
	St Marys	Penrith	Back to depot	10
8/5/00	Penrith	B'town	Pick up goods	35
	B'town	Mt Druitt	Deliver goods	20
	Mt Druitt	Penrith	Pick up goods	17
	Penrith	Penrith	Back to depot	2

Use the information on the vehicle running sheet to answer the following questions.

1) How many kilometres did the driver travel on each of the days?

a) 6/5/00 \_\_\_\_\_ b) 7/5/00 \_\_\_\_\_ c) 8/5/00 \_\_\_\_\_

2) How many kilometres did the driver travel over the three days? \_\_\_\_\_

3) The driver is paid 50c (= half or 0.5 of a dollar) per kilometre as a travel allowance. How much would the company pay him for his travel over the three days?

## Converting between Units of Length

Sometimes there is a need to convert (change) a measurement from one metric unit of length to another. An example of this may be to convert a measurement from centimetres to millimetres.

The equivalent values for standard units of length are:

1 kilometre (km) = 1000 metres (m)

1 metre (m) = 100 centimetres (cm)

1 centimetre (cm) = 10 millimetres (mm).

Some other equivalent values:

100 metres (m) = 0.1 kilometres (km)

1 metre (m) = 1000 millimetres (mm)

### Example

An object which is 128 cm long can have its length shown in four different ways:

128 cm    1280 mm    1 m 28 cm    1.28 m



## Measurement in the Workplace

**A. Same Measure, Different Value**

Fill the spaces in the table below, showing the equivalent values for the lengths given. The first one is done for you.

Millimetres	Centimetres	Metres + centimetres	Metres (decimal)
1560 mm	156 cm	1 m 56 cm	1.56 m
2680 mm			
	458 cm		
		3 m 65 cm	
			6.25 m
5060 mm			
	680 cm		
		6 m 39 cm	
			7.74 m

**B. Estimate and Check**

Circle the most accurate answer — estimate first, then check by measuring accurately.

1) How wide is an ordinary CD?

- a) 50 mm    b) 12 cm    c) 42 cm    d) 0.3 km

2) How thick is a matchstick?

- a) 0.8 cm    b) 10 mm    c) 2 mm    d) 2 m

- 3) How long is an adult man's shoe?
- a) 60 cm    b) 500 mm    c)  $\frac{1}{4}$  m    d) 300 cm
- 4) What is about 15 cm long?
- a) shoelace    b) bread-knife blade    c) desk    d) big toe
- 5) Which would be about 4 m high?
- a) soccer goalpost    b) truck    c) table    d) basketballer

## Perimeter

The perimeter of an area is the total length of its outer boundary — for example, the length right around the outside of the top of a table, or around the walls of a room.

Many workers need to know how to work out the perimeter of items or spaces. For example, a fence builder has to work out the perimeter of a block of land in order to calculate the necessary quantity of fencing materials.



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### ACTIVITY

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### Measurement in the Workplace

#### A. Perimeters at Work

List five jobs in which you might need to know how to calculate perimeter.

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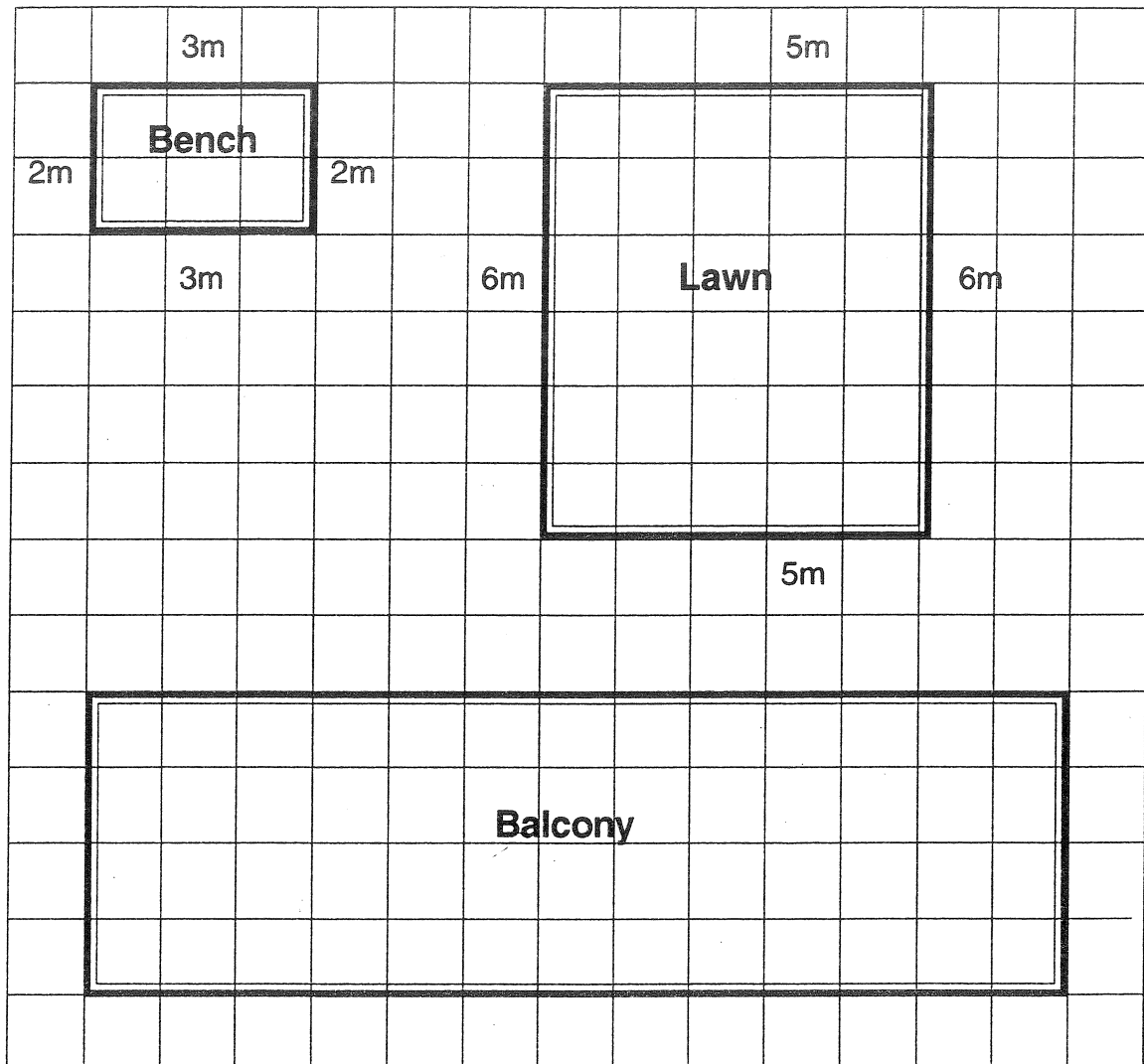
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## B. Grid Reading

Look at the items and spaces on the grid paper. Carefully read the measurements (dimensions) of each one.



Each shape is drawn to a *scale* of 1 cm = 1 m.

- 1) Write the dimensions for the balcony on the grid (in metres).
- 2) All of these shapes are \_\_\_\_\_.
- 3) How could you calculate the perimeter of the bench, the lawn or the balcony?

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- 4) A quick way to calculate the perimeter of a rectangle is to use this formula:

$$\text{Perimeter} = 2 \times (\text{length} + \text{width})$$

Suppose a bench is 3 m long and 2 metres wide.

$$\begin{aligned}\text{Perimeter} &= 2 \times (3 \text{ m} + 2 \text{ m}) \\ &= 2 \times 5 \text{ m} \\ &= 10 \text{ m}\end{aligned}$$

*Hint: add the numbers in the brackets before multiplying by 2*

Now use this formula to find the perimeter of the:

**lawn**

$$\begin{aligned}\text{Perimeter} &= \underline{\hspace{2cm}} \times (\underline{\hspace{2cm}} + \underline{\hspace{2cm}}) \\ &= \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \\ &= \underline{\hspace{2cm}} \text{ m}\end{aligned}$$

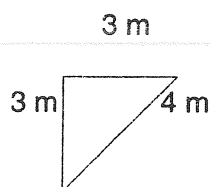
**balcony**

$$\begin{aligned}\text{Perimeter} &= \underline{\hspace{2cm}} \times (\underline{\hspace{2cm}} + \underline{\hspace{2cm}}) \\ &= \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \\ &= \underline{\hspace{2cm}} \text{ m}\end{aligned}$$

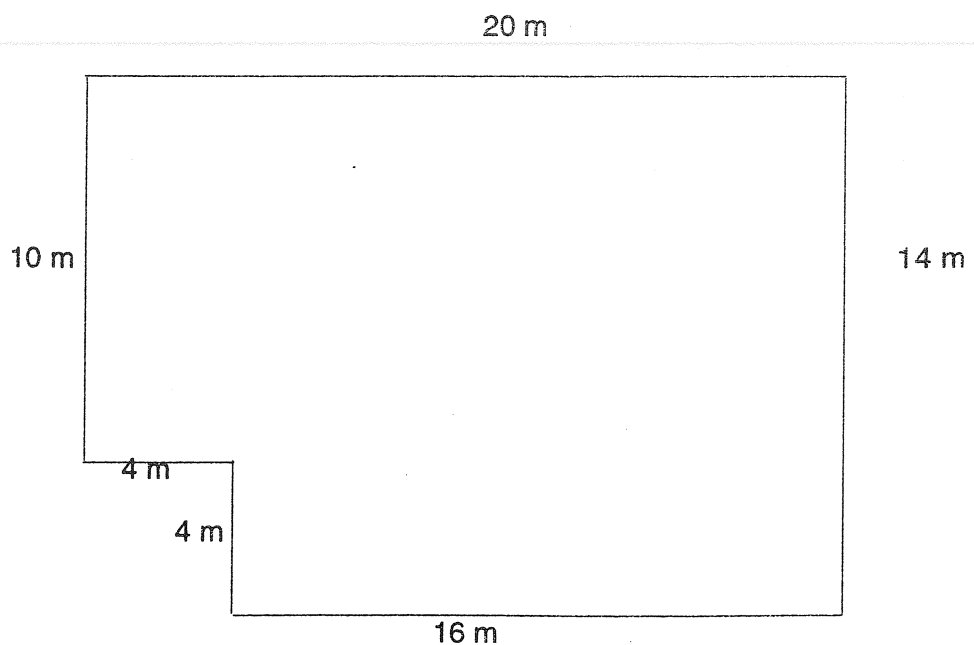
### C. Irregular Shapes

Not all items and spaces are rectangular. Many have irregular shapes. Look at these.

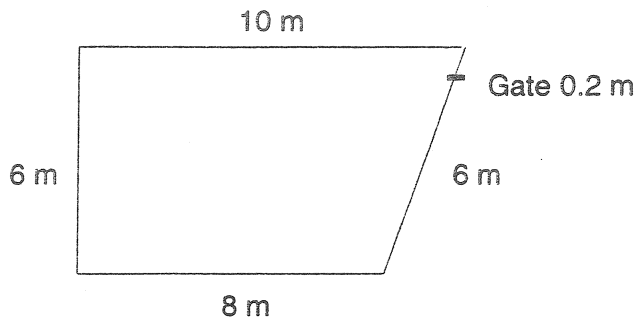
**Garden**



**Block of Land**





**Pool Area**

- 1) The garden needs a treated log border. Logs cost \$9.00 per metre. How much will it cost to buy the logs needed to build the border? Fill the spaces to work out your answer.

If the total cost of the logs is (perimeter in m) x (cost per m)

and the perimeter of garden is \_\_\_\_\_ m,

and the cost of the logs is \_\_\_\_\_ per m,

then the total cost of the logs is \_\_\_\_\_ x \_\_\_\_\_

= \$ \_\_\_\_\_

- 2) You have to build a fence around the block of land. The fencing materials cost \$15 per metre. How much will the materials for the fence cost?

Perimeter of land = \_\_\_\_\_ m.

Cost of fencing = \_\_\_\_\_ per m.

So the total cost of materials = \_\_\_\_\_ x \_\_\_\_\_

= \$ \_\_\_\_\_

- 3) You work for a paver, and the owners of the pool area want you to build a block border around the area. Edging blocks cost \$12.50 per metre. How much will the blocks cost for this job? Use the formula you have learned.

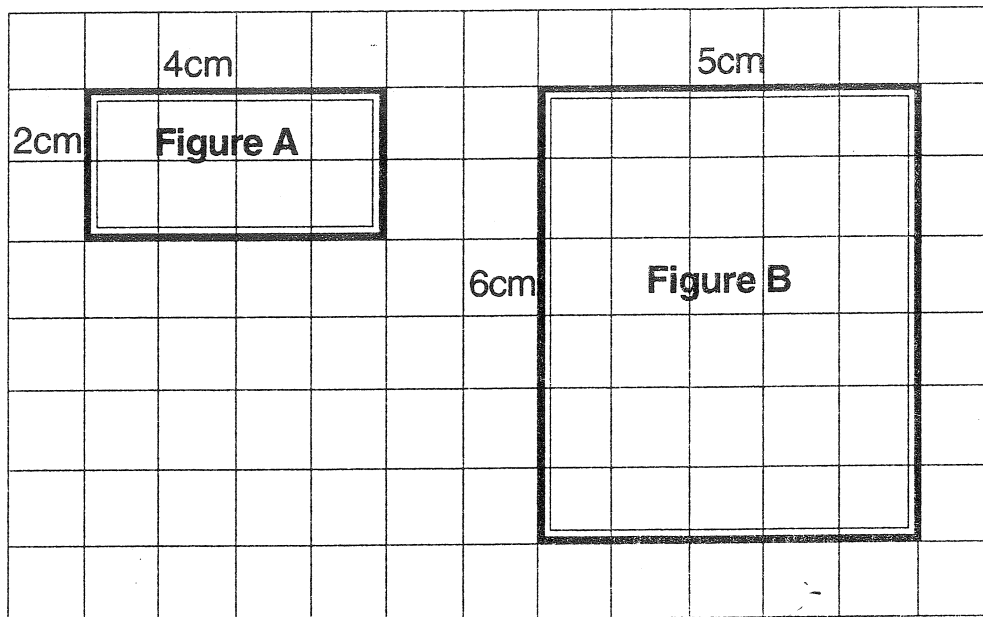
Answer: \$ \_\_\_\_\_ .

## Area

Area is the amount of space of a flat surface such as a floor, a wall or a lawn.

If you need to work out how much carpet to cover a floor or paint to cover a wall, you will need to calculate area.

Look at the grid below. It is made up of squares that are 1 cm long and 1 cm wide. The *area* inside each square is 1 square centimetre, which can be written as 1 cm<sup>2</sup>.



Count the number of squares that Fig. A covers. The area of Fig. A = 8 cm<sup>2</sup>.

Now count the squares that Fig. B covers. The area of Fig B = \_\_\_\_\_ cm<sup>2</sup>.

A quick way to calculate the area of rectangular spaces is to use this formula:

Area = Length x Width

In Fig. A      Area = 4 cm x 2 cm = 8 cm<sup>2</sup>

In Fig. B      Area = \_\_\_\_\_ x \_\_\_\_\_ = \_\_\_\_\_ cm<sup>2</sup>




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 ACTIVITY
 

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 Measurement in the Workplace
 

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**Area on the Job**

1) Use the formula to calculate the area of:

a) a wall 3 m long and 2 m high

$$\text{Area} = \underline{\quad} \times \underline{\quad} = \underline{\quad} \text{ m}^2$$

b) a floor 8 m long and 5 m wide

$$\text{Area} = \underline{\quad} \times \underline{\quad} = \underline{\quad} \text{ m}^2$$

2) A customer comes to the paint and paper shop where you work. She wants to paper a wall that is 5 m long and 2 m high. How many square metres of paper will she need?

$$\text{Area} = \underline{\quad} \times \underline{\quad} = \underline{\quad} \text{ m}^2$$

The paper she likes is \$15.00 per square metre. How much will it cost her?

$$\text{Cost} = \underline{\quad} \times \underline{\quad} = \$ \underline{\quad}$$

3) You have to lay a lawn for a client whose yard is 15 m wide and 20 m long. Turf costs \$8.50 per m<sup>2</sup>. How much will you charge your customer?

$$\text{Lawn area} = \underline{\quad} \times \underline{\quad} = \underline{\quad} \text{ m}^2$$

$$\text{Cost} = \underline{\quad} \times \underline{\quad} = \$ \underline{\quad}$$

# Mass and Weight

## What Is Mass?

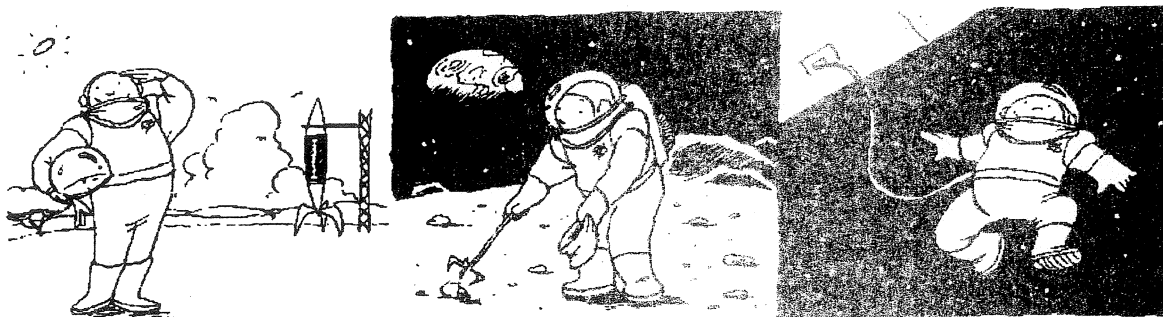
Mass is the amount of matter in an object.

(An object's mass does not change from place to place.)

## What Is Weight?

Weight is a measure of the mass of a body and the gravitational force acting on the body.

The mass of our bodies stays the same. But our weight is affected by gravity. Our weight changes if gravity changes.



**Astronaut on Earth**  
Weight = 80 kg

**Same astronaut on moon**  
Gravity is one-fifth of Earth's  
Weight = 16 kg

**Same astronaut in space**  
No gravity  
Weight = 0 kg

There is often confusion about the difference between weight and mass. In everyday conversation, we usually talk about the mass of an object as its weight. We take for granted that the object is affected by the gravitational force on Earth at sea level.

## Standard Metric Units of Weight

The standard base SI unit of weight is the kilogram.

The standard metric units used for measuring weight are:

- grams
- kilograms
- tonnes.

1000 milligrams (mg)	= 1 gram (g)
1000 grams (g)	= 1 kilogram (kg)
1000 kilograms (kg)	= 1 tonne (t)

Different scales are used to measure weight, depending on the weight of the object. Some examples are a bathroom scale, produce scale, kitchen scale, spring scale and, for very large weights, a weighbridge.

In industry, the weight of items is important for many reasons. For example:

- Some pieces of machinery can only lift certain weights before the machine will break.
- The weight of some goods may be too heavy to lift without using a machine.
- The weight of packaged items such as food need to be exact to the gram.
- Trucks have a maximum weight they can carry.

## Measuring in Grams (g)

A gram is a small unit of measurement of weight, just as a centimetre is a small unit of measurement of length.

A teaspoon holds about 5 grams. So 1 gram would be the weight of just a few grains of rice.

A lot of things in industry are weighed in grams. Packaged food is probably the most common. The law requires that the nett weight (the weight of the food without the packaging) must be recorded on the packet. For example, a packet of biscuits may be 250 grams; a packet of flour may be 500 grams.

To measure something in grams requires a fair degree of accuracy, as it would only take a very small amount to be a few grams over or under the weight needed.

Commercially, measurement in grams is most common in the retail food industry. For example, a delicatessen customer might ask for a certain number of grams of cheese or meat.

Other retail items weighed by the gram are:

- hardware items like nails
- cosmetics
- stationery items like glue.

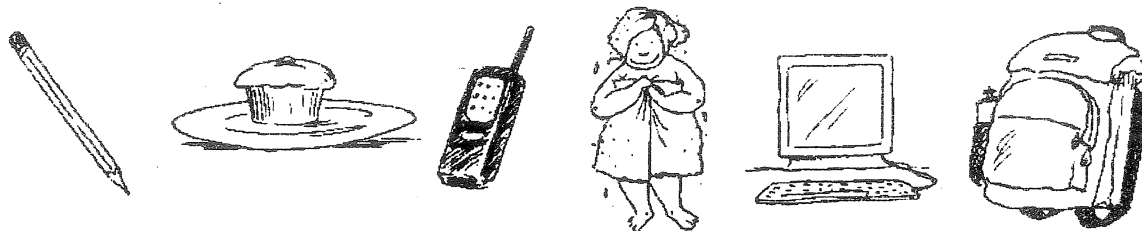


## ACTIVITY

### Measurement in the Workplace

#### Measuring in Grams

- 1) Tick the items you would weigh in grams.



- 2) Look at the items listed below. Estimate their weight in grams. Check your estimates by weighing each item with a kitchen scale. Write your findings in the table below.

Item	Estimated weight (g)	Actual weight (g)
Pen		
Pencil sharpener		
Writing book		
Folder		
Pencil case		

#### Measuring in Kilograms (kg)

A common unit of measurement across industries is the kilogram. Many fresh food items such as fruit, vegetables and meat are sold at a price per kilogram (e.g mince at \$6.99/kg).

Kilograms are used in the hospitality industry in the ordering and preparation of food. A large variety of scales are available for both domestic (home) and commercial (workplace) use.

Kilograms are not only used to measure food at work. Measuring kilograms accurately is very important in many industries. Other examples are:

- the airline industry — needs to weigh luggage to make sure aeroplanes are not overloaded
- supply and delivery services — need to measure bulky goods such as bags of mail (letters) in kilograms, so that the people who have to move and lift them can use the correct machines for lifting if they need to.

Knowing how much something weighs is important for occupational health and safety. Permanent back damage can result from lifting something that is too heavy. Guidelines on safe lifting are available from WorkCover.



## ACTIVITY

### Measurement in the Workplace

#### Measuring in Kilograms

When weighing an item on scales, it is important to know how to read and record parts of a kilogram. On most scales, parts of a kilogram are measured in tenths, and are written as a decimal (one tenth, or  $\frac{1}{10}$ , of a kilogram is written as 0.1 kg). So one-and-a-half kilograms is written as 1.5 kg. (This is the same thing as 1500 g.)

- 1) Write these weights in decimal parts of a kilogram.

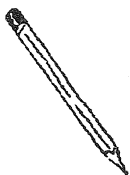
1200 g \_\_\_\_\_ 3250 g \_\_\_\_\_ 12 000 g \_\_\_\_\_

7500 g \_\_\_\_\_ 2990 g \_\_\_\_\_ 15 500 g \_\_\_\_\_

6210 g \_\_\_\_\_ 5400 g \_\_\_\_\_ 20 000 g \_\_\_\_\_

- 2) Tick the items you would weigh in kilograms.

- 3) Look at the items listed below. Estimate their weight in kilograms. Check your



estimates by weighing each item with a bathroom scale. Write your findings in the table below.

Item	Estimated weight (kg)	Actual weight (kg)
Box of books		
Half-packed school bag		
Fully packed school bag		
Folder		
Pencil case		

## Measuring in Tonnes (t)

A tonne is a unit of measurement for very large and bulky goods. It is the measurement most used in the farming, transport and mining industries. Specialised equipment is used to measure these types of goods.

The carrying capacity of trucks is measured in tonnes. The Roads and Traffic Authority (RTA) has very strict rules regarding the amount trucks can carry. There are weighing stations along main highway routes at which loaded trucks are weighed.

## Converting between Standard Units of Weight

As with length, there is sometimes a need to convert (change) a measurement from one standard unit of weight to another standard unit of weight. An example of this may be to convert a measurement from grams to kilograms.

### Equivalent Values for Standard Units of Weight

1 tonne (t) = 1000 kilograms (kg)

1 kilogram (kg) = 1000 grams (g)

Which means that:

100 g = 0.1 kg

250 g = 0.25 kg

500 g = 0.5 kg.





## ACTIVITY

## Measurement in the Workplace

## A. Conversion

Complete the table below.

Grams	Kilograms + Grams	Kilograms (Decimal)
	1 kg 500 g	
3800 g		
		4.5 kg
1250 g		
	2 kg 250 g	
		4.5 kg

## B. Estimation

How much does each object weigh?

Item	Estimate (kg)	Weight (kg)
CD		
Shoe		
Shoelace		
Pencil case		
Backpack		
Large book		
Small book		

## Gross and Nett Amounts

Two common terms used in many industries, particularly in packaged goods, are *gross* and *nett*.

### Gross

The term 'gross' means the total amount of something.

For large, bulky items such as supplies to a manufacturer, the gross (or total) weight may be recorded on the packaging. This information helps the people receiving the goods to work out if a machine such as a forklift is needed to lift the goods, and to work out if the right amount of the item has been delivered.

### Nett

The term 'nett' (or 'net') means the amount that is left after extras, like packaging, are taken away.

The most common place to see nett weight is in the supermarket, where it is written on packaged goods. Nett weight is displayed so that the customer knows exactly how much of the product they are getting without the packaging. Customers can compare the amount in each package from different brands to work out the best value.

If the gross weight were displayed on supermarket goods — say tinned tomatoes — it would be extremely difficult to work out the amount of goods contained, because you would have to know the weight of the tin.

### Calculating Nett Weight

**nett weight = gross weight – weight of container**

For example:

Gross weight of cornflakes = 430 g

Container weight = 55 g

So nett weight = 430 – 55

= 375 g




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**ACTIVITY**


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**Measurement in the Workplace**
**Gross and Nett Weights**

1) Complete the following table.

Item	Gross weight	Container weight	Nett weight
A	400 g	50 g	
B	700 g		625 g
C		35 g	240 g
D	950 g	60 g	
E	525 g	40 g	

2) Using five packaged products and kitchen scales, work out the nett and gross weights, and the weight of the containers.

Product	Nett weight	Gross weight	Container weight
Margarine	500 g	520 g	20 g
1.			
2.			
3.			
4.			
5.			

## Safe Lifting

WorkCover has recommended guidelines on safe lifting at work. These include the use of manual handling aids such as trolleys and forklifts.

Manual handling aids or machines that are used to lift weights each have a *safe working load* (SWL). The safe working load is the amount the machine can lift safely without being overloaded. The total weight of the items being moved at any one time cannot add up to more than the SWL.

If the item to be moved is very heavy, a forklift may be needed. A special licence is needed to drive a forklift. The SWL of a forklift is usually given in tonnes.

Cranes are used for extremely heavy, irregular-shaped or very large objects. They are mostly used on building and construction sites. A crane can only be operated by a licensed crane driver. Cranes also have a SWL.



### ACTIVITY

### Measurement in the Workplace

## Safe Lifting

- 1) What is a SWL? \_\_\_\_\_
- 2) The SWL of a trolley is 250 kg. Which of the following items could you use this trolley to move? Circle them.
  - a) 200 kg fridge
  - b) five boxes of oranges weighing 20 kg each
  - c) ten bails of hay weighing 30 kg each
  - d) 80 boxes of paper weighing 25 kg each
  - e) one microwave oven (boxed) weighing 30 kg

- 3) If this trolley was the only help you had, how could you lift the items above that total more than the SWL?

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- 4) If you had the use of a 2.5-tonne capacity forklift, how many loads would be needed to move the following items?

- a) ten concrete blocks weighing 1 tonne each \_\_\_\_\_
- b) 15 fridges weighing 300 kg each \_\_\_\_\_
- c) 50 bags of cement, each bag weighing 40 kg \_\_\_\_\_
- d) 100 boxes of paper weighing 25 kg each \_\_\_\_\_
- e) one 4-tonne statue \_\_\_\_\_

## Tare Weight

Trucks also have limits on the amount they can carry. The laws about how much trucks can carry are well enforced, because overloaded trucks are dangerous and put other drivers at risk.

The weight of a truck before anything is put into it is called the *tare* weight. It is important to remember to add the tare weight to the weight of the truck's load to get the total (gross) weight of the truck.

The total weight of a truck is important when, for example, a road or bridge has a maximum safe vehicle weight.

Remember: Tare weight is the weight of the *vehicle only*, without the load.

For example:

A ute has a tare weight of 2.5 t and can carry 1.1 t. What is the total weight of the ute when it is fully loaded?

Total weight = carrying capacity + tare weight

In this case = 1.1 + 2.5

= 3.6

The total weight of the ute is 3.6 tonnes.



## ACTIVITY

## Measurement in the Workplace

**Tare Weight**

- 1) A small truck can carry up to 2.5 t. Its tare weight is 3 t.
- a) What is its total weight when fully loaded? \_\_\_\_\_
  - b) If it was carrying a 1 t load, what would its total weight be? \_\_\_\_\_
  - c) If it was carrying a 0.5 t load, what would its total weight be? \_\_\_\_\_
- 2) A semi-trailer can carry 22 t. Its tare weight is 15 t.
- a) What is its total weight when fully loaded? \_\_\_\_\_
  - b) What is its total weight when its load is 7 t? \_\_\_\_\_
  - c) What is its total weight when it is loaded with half of its carrying capacity? \_\_\_\_\_

# Volume and Capacity

## What Is Volume?

Volume is the amount of space that an object takes up. Volume is a measure of the space occupied by gases, liquids and solids.

## What Is Capacity?

The capacity of a container is the volume it can hold.

## Standard Metric Units of Volume or Capacity

The standard base SI unit of volume/capacity is the cubic metre.

1 cubic metre = 1000 litres.

The volume of a liquid is usually measured in litres and/or millilitres.

## Standard Metric Units of Liquid Volume

1000 millilitres (mL) = 1 litre

1000 litres (L) = 1 kilolitre (kL)

Some tools used to measure the volume of liquids include teaspoons, tablespoons, medicine glasses, measuring cylinders, jugs and petrol pumps like those at your service station.

## Measuring in Litres (L)

The standard metric unit for measuring the volume of liquids in industry is the litre. Even very large amounts of liquid are measured in litres. This means that measurements like 10 000 litres or even 1 million litres may be used.

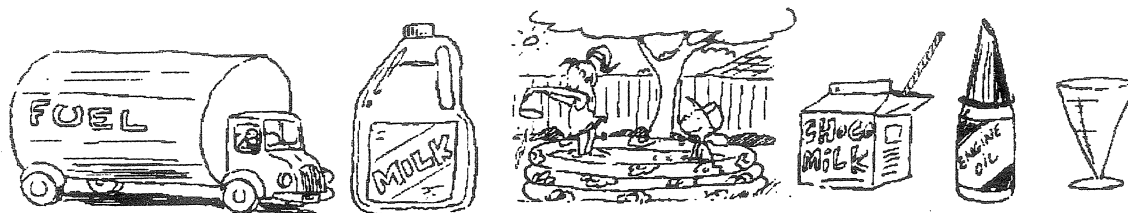


## ACTIVITY

## Measurement in the Workplace

## Volume and Capacity

- 1) Tick the items that you would measure in litres.



- 2) Using a measuring container, measure the following amounts of water:

3 litres    6 litres     $\frac{1}{2}$  litre    2.5 litres     $3 \frac{1}{4}$  litres

- 3) Estimate and then measure the amount of water the following containers will hold.

Container	Estimated volume	Measured volume
Ice-cream container		
Waste-paper bin		
Bucket		
Tote tray		



## Measuring in Millilitres (mL)

Millilitres are the smallest liquid volume measure commonly used in most industries. For example, 100 mL of milk may be spoken of as 100 'mills' of milk.

Millilitres are used in industries that use small quantities. This unit of measure is often used in the hospitality industry, particularly in small businesses where small quantities of food are cooked.

Millilitres are also used in areas where measurement needs to be exact; for example, medicine is measured in mL.



### ACTIVITY

### Measurement in the Workplace

#### A. Measuring in Millilitres

- 1) Use a medicine glass to measure the capacity (in mL) of:

a teaspoon \_\_\_\_\_ a dessert spoon \_\_\_\_\_

an egg cup \_\_\_\_\_ a tablespoon \_\_\_\_\_

a teacup \_\_\_\_\_

- 2) Estimate and then measure the amount of water that the following containers will hold.

Container	Estimate (mL)	Measurement (mL)	Difference (mL)
Glass jar			
Teacup			
Coffee mug			
Vase			

## B. Litres or Millilitres?

- 1) For each product below, decide which unit of measure would be used — litres or millilitres.

water in a glass \_\_\_\_\_ medicine in an eye dropper \_\_\_\_\_

petrol in a tank \_\_\_\_\_ water in a bath \_\_\_\_\_

sauce in a jug \_\_\_\_\_ juice in a punch bowl \_\_\_\_\_

bottle of cough syrup \_\_\_\_\_ cream in a small container \_\_\_\_\_

- 2) Remembering that  $1000 \text{ mL} = 1 \text{ L}$ , use the short form to write:

365 millilitres \_\_\_\_\_ 2000 millilitres \_\_\_\_\_

50 millilitres \_\_\_\_\_ 4000 millilitres \_\_\_\_\_

990 millilitres \_\_\_\_\_ 675 millilitres \_\_\_\_\_

## C. Punch Posers

You are employed by a catering company to help prepare food and drink for an office party function. The chef has put you in charge of making up the punch.

The recipe for the punch is:

500 mL lemonade  
500 mL ginger ale  
750 mL orange juice  
250 mL white wine

Use this information to answer the following questions.

- 1) How much punch (in mL) will this recipe make up? \_\_\_\_\_

- 2) This recipe makes enough for 8 people. How much of each ingredient would you need for 32 people? (To make these calculations, you need to know how many times to multiply each measurement. Hint: How many lots of 8 are in 32?)

Ingredient	Original quantity	New quantity
lemonade		
ginger ale		
orange juice		
white wine		

- 3) If you only wanted enough drink for four people, how much of each ingredient would you need?

Ingredient	Original quantity	New quantity
lemonade		
ginger ale		
orange juice		
white wine		

## Measuring with Metric Cups and Spoons

Cups, tablespoons and teaspoons are other units that can be used to measure capacity. There are set relationships between these units. For example:

1 teaspoon (tsp) = 5 mL

4 teaspoons = 1 tablespoon

1 tablespoon (tbsp) = 20 mL

4 tablespoons = 1/2 cup

1 cup = 250 mL

4 cups = 1 L




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**ACTIVITY**


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**Measurement in the Workplace**
**Metric Cups and Spoons**

- 1) **Beside each of the following, write which unit would be best to use when measuring — teaspoon, tablespoon, cup, millilitres or litres.**

flour	_____	oil	_____
sugar	_____	tea	_____
soft drink	_____	swimming pool	_____
chocolate milk	_____	fish bowl	_____

- 2) **Complete the following sentences.**

- a) 4 teaspoons equals one \_\_\_\_\_ .
- b) To measure 5 mL of medicine, you could use a \_\_\_\_\_ .
- c) To make one hot chocolate, you would need one \_\_\_\_\_ of milk.
- d) When adding salt to a cake recipe, you would probably use a \_\_\_\_\_ .
- e) To measure a litre of water, you could use 4 \_\_\_\_\_ .
- f) Petrol is measured in \_\_\_\_\_ .

- 3) **Solve the following kitchen problems.**

- a) How could you measure 125 mL of milk using a 250 mL cup?

\_\_\_\_\_

- b) How could you measure 200 mL of water using a 250 mL cup?

\_\_\_\_\_

- c) Rewrite the following recipe to make half as much chocolate icing.

2 tbsp milk \_\_\_\_\_

1 tbsp cocoa powder \_\_\_\_\_

80 g butter \_\_\_\_\_

2 1/2 cups icing sugar \_\_\_\_\_

- d) Rewrite the following recipe to make twice as much vanilla milkshake.

1 1/2 cups milk \_\_\_\_\_

1/2 tsp vanilla \_\_\_\_\_

1 scoop ice-cream \_\_\_\_\_

